REEL TINES

FIELD OF THE INVENTION

[0001] The invention relates to attaching a reel tine onto a carrier tube of a reel. The carrier tube is drilled through crosswise. The carrier tube has, in the area of two attachment bores, arranged on one bore axis and extending through the wall of the carrier tube, countersink portions directed toward the inside of the carrier tube. The reel tine is retained by a screw on the carrier tube.

BACKGROUND OF THE INVENTION

[0002] The reel of a harvesting machine generally includes several carrier tubes. The carrier tube are radially distanced from a central tube and are circumferentially distributed around the central tube. The carrier tubes are supported by corresponding bearing arms. The carrier tubes are pivotably supported on the bearing arms. Since the width of the cutting table of a harvesting machine is especially large in modern machines, the reels and carrier tubes are also correspondingly long. The carrier tubes carry reel tines which are distributedly arranged along the carrier tube's length. For example, on a six meter long carrier tube, 40 or more tines are generally attached to the carrier tube. Thus, in a reel with six carrier tubes, 240 tines are provided.

[0003] Preferably, two basic types of reel tines are used. Reel tines made from steel are preferred to harvest goods, which are difficult to collect and transport to the cutting table of the cutting section. For example, these tines are used on cereals and especially on cereals lying on the ground or in grass harvesting.

[0004] For other harvesting goods, for example beans and other leguminous fruit, reel tines made from plastic materials are preferred. The above named harvesting goods must be cut close to the ground since the first shoots, which are on stalks, already grow close to the ground. In modern machinery, which includes very wide cutting tables on the harvesting devices, for example combine harvesters, in order to harvest these goods, very flexible cutter bars are used. The cutter bars in the operating position are guided in contact with the ground in front of the cutting table, which cuts the harvesting good. On uneven ground, these flexible cutter bars carry out at least a partial vertical movement relative to the cutting table. In this case, when lifting the cutter bar, it happens, that one or a multitude of reel tines get between the reciprocating blades of the cutter bar. As happens with reel tines made from plastic, the tips are sheared off. However, no negative influence occurs to the blade nor the cutter bar drive.

[0005] Generally in carrier tubes, cross-wise extending attachment bore are punched into the carrier tubes. The deformations around the bores are in the form of countersink portions. When the bores are produced from diametrical sides, the carrier tube is provided with two funnel-like countersink portions in opposite directions. Different reel tines, made from plastic materials, are known which can be attached to such carrier tubes.

[0006] United States Patent No. 4,882,899 discloses a reel tine manufactured from plastic material. The tine has a clip-like portion which encloses the carrier tube. The two opposed attachment portions are clamped against each other by a screw. Furthermore, a projection is formed on the bore portion enclosed by the clip portion. The projection engages the recess or sink portion of the carrier tube. Furthermore,

lateral wing-like profiled strips are formed on the reel tines. One of the strips has at its free end face, a recess and the other one a projection. During strong radial loading, the enclosing strip is deformed. The pin-like lug leaves the bore and a rotational displacement is produced relative to the carrier tube. Thus, the reel tine cannot fulfil its function. The formed wing-like profiled strips extend over half the distance to a neighbouring reel tine. The profile strips engage with the opposite directed profiled strip of the neighbouring tine by a tongue and groove connection. This connection is, however, unstable. Thus, when a reel tine is displaced on the carrier tube due to overloading, the tongue and groove connection is also detached. Furthermore, in this construction the distances of the reel tines on the carrier tube have to correctly correspond to each other. A later adaptation is not possible, when replacing the tines.

[0007] United States Patent No. 6,199,358 relates to a reel tine made from plastic material. The tine has an attachment portion with a recess, which forms an abutment face to a portion on the outer face of the carrier tube. The carrier tube has two attachment bores arranged on one bore axis. Different from the common design, the bores are not part of the countersink portions. A pin projection is provided in the area of the recess of the attachment portion of the reel tine which includes a bore. The reel tine projects with this pin projection through the attachment bore into the inside of the carrier tube. Starting from the opposite attachment bore, a screw with a countersunk head is screwed into and retains the reel tine on the carrier tube. The raking-in portion is rod-like and bent and has a front contact face. It is tapered widthwise from an approximately centre portion in the direction of its free end. A disadvantage is that the projection, made from plastic material, has to absorb

full loading in connection with the screw. Accordingly, detaching often results during loading when a strong tensile force acts onto the screw.

[0008] Finally, U.S. Patent No. 6,324,823 B1 describes a reel tine made from plastic material. The tine can be attached on a carrier tube provided with diametrical countersink portions. It has an elongated attachment portion where cone-like formed-on thickenings are provided to fill the sink portions of the carrier tube. A screw is passed through these thickenings. The carrier tube and clamping of the carrier tube is achieved by a nut screwed onto the head screw. The thickenings also engage in the diametrical attachment bores. A disadvantage is that the use of a head screw with a nut leads to an enlarged diameter. Thus, the projecting portion leads to easily winding harvesting goods that can be entangled on the screw.

SUMMARY OF THE INVENTION

[0009] According to the invention, a reel tine is provided with a raking-in portion and attachment portions which are integrally or unitarily formed from plastic material. The tines can be securely positioned and attached onto a carrier tube. Thus, during strong loading, no displacement occurs on the carrier tube or is the screw connection detached. Furthermore, the tines ensure that the harvesting good does not get entangled. The reel tine should also, without necessitating a form change on the attachment portion and raking-in portion, be useable on tubes having different sink portions or tubes, which have no sink portions.

[0010] The invention has a reel tine attached by a screw onto a carrier tube of a reel. The carrier tube is drilled through cross-wise to form two attachment bores. Especially, in the area of the two attachments bores, which are arranged on one bore axis and extend through the wall of a carrier tube, two countersink portions are

directed inwards. A raking-in portion, formed in a rod-like configuration, has a front contact face. An attachment portion is integrally or unitarily formed with the raking-in portion from a plastic material. The attachment portion has a recess with an abutment face to abut on the carrier tube. A first bore portion starts from the abutment face. A second bore portion, to receive the threaded shaft of the screw, starts from the first bore portion. A connection sleeve has a first sleeve portion which is accommodated in the first bore portion. The sleeve has a second sleeve portion insertable into an attachment bore.

[0011] The connection sleeve enable tines to be adapted to differently formed carrier tubes without the need to change the connection portion, which is unitarily formed with the raking-in portion. Thus, the connection sleeve can be adapted to the different bore forms of the attachment bores in the carrier tube. Furthermore, the connection sleeve can be made from a hard wearing material which is also less sensitive to shear stress. The depth of the first bore portion in the attachment portion achieves a sufficiently advantageous connection to the connection sleeve. Furthermore, the abutment face of the recess of the attachment portion can be formed such that an adaptation or attachment, respectively, to carrier tubes with different diameters is possible.

[0012] In cases where the carrier tubes have sink portions, it is sensible to have a connection sleeve with a radially projecting collar separating the first sleeve portion from the second sleeve portion. This collar can be, for example, used to fill-out the sink portion. According to the invention, an adaptation to the different carrier tube shapes can be achieved in an identical design of the plastic raking-in portion with the connection portion. Thus, only a connection sleeve adapted to the respective carrier

tube is used. Thus, the tools necessary for the manufacture of the plastic material component need only be of one single design. This significantly reduces the tool costs.

[0013] In order to achieve the necessary rigidity in the area of the raking-in portion, at least one reinforcement rib is provided on the raking-in portion on its face facing away from the front contact face. The at least one reinforcement rib starts from the attachment portion and ends in front of a free end of the raking-in portion. An especially advantageous design is achieved when two ribs are provided. The ribs approach each other starting from the attachment portion in a direction towards the free end, and, for example, merge. Thus, the ribs have the largest distance in the area of the attachment portion. Preferably, the height of the ribs decreases in the direction to the free end of the raking-in portion. Also the width of the contact face of the raking-in portion decreases towards the free end.

[0014] In an advantageous embodiment, the area including the connection portion and the raking-in portion is made from an elastic plastic material. Preferably, the reel tine is made from a polyamide material (PA), a polyoxymethylene material (POM) or a polypropylene material (PP). Preferably, the connection sleeve is made from metal, especially steel, or a tough plastic material. In cases where additional profiled strips are used, the attachment portion has grooves at its two side faces to accommodate the ends of a profiled strip. In cases where the pitch of the attachment bore on the carrier tube is not exactly maintained, it is possible to adapt the profiled strip during the exchange or in the working environment by cutting it into lengths from a larger profiled strip into the given conditions. This is also possible when a laterally projecting profiled strip is formed on the attachment portion at one side and the

attachment portion has a groove on the side face facing away from the same. The groove accommodates the profiled strip of a neighbouring reel tine. Accordingly, when a sufficiently large profiled strip length is provided, an adaptation is still possible during an exchange in the working environment.

[0015] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0017] Fig. 1 is an exploded side view, together with the cross-wise cut carrier tube and the screw in accordance with a first embodiment of a reel tine according to the present invention.

[0018] Fig. 2 is a cross-sectional view of the reel tine of Fig. 1 mounted on the carrier tube.

[0019] Fig. 3 is a rear elevation view of the reel tine of Fig. 2 in the direction of the arrow A of Fig. 2.

[0020] Fig. 4 is a rear elevation view of another embodiment of a reel tine.

[0021] Fig. 5 is a side elevation view of the reel tine of Fig. 4 in the direction of the arrow B of Fig. 4.

[0022] Fig. 6 is a rear elevation view of two reel tines attached on a carrier tube with a connection strip.

[0023] Fig. 7 is a cross-sectional view of Fig. 6 along line VII-VII thereof.

[0024] Fig. 8 is a rear elevation view of a further embodiment of a reel tine with two reinforcement ribs.

[0025] Fig. 9 is a cross-sectional view of Fig. 8 along line IX-IX thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0027] In Fig. 1, a first embodiment of a reel tine 1 is shown in an exploded view with reference to the attachment onto a reel carrier tube 2. The carrier tube 2 has a first attachment bore 3 and a second attachment bore 4 arranged on the same bore axis 5. The bores 3, 4 are arranged diametrically opposite and are part of a first sink portion 6 and a second sink portion 7, respectively. The sink portions 6, 7 are off-set relative to the outer face 8 of the carrier tube 2 inside towards the rotational axis 9 of the carrier tub 2.

[0028] The reel tine 1 includes a raking-in portion 10 with a contact face 11 arranged at the front of the raking-in portion 10. The contact face 11 is in front, in a rotational direction, of the carrier tube 2. An attachment portion 12 is unitarily or integrally formed with the raking-in portion 10. The reel tine 1 has a free end 14 remote from the attachment portion 12. Diametrically to the free end 14 is the attachment portion 12. The attachment portion 12 includes a recess with an abutment face 13. The abutment face 13 abuts the outer face 8 of the carrier tube 2. A first bore portion 16 starts from the abutment face 13 in a direction towards the

raking-in portion 10. The first bore portion 16 has a larger diameter than a second bore portion 17, which starts from the first bore portion.

[0029] A connection sleeve 18 has a through bore 19. The connection sleeve 18 has a first sleeve portion 20 which is form fit into the first bore portion 16 in the attachment portion 12. The connection sleeve 18 has a second sleeve portion 21 which form fits into the second attachment bore 4. The sleeve portion 21 passes through the bore 4. The connection sleeve 18 has a collar 22 that separates the first sleeve portion 20 from the second sleeve portion 21. The collar 22 projects radially with respect to the axis 23 of the through bore 19. The collar 22 at least partially fills the sink portion 7 as seen in Fig. 2. In the case, the carrier tube is provided without a sink portion, the collar can be omitted.

[0030] A screw 24 serves to additionally retain the reel tine 1 on the carrier tube 2. The screw 24 has a head 25, formed as a countersunk head, and a threaded shaft 26. The shaft 26 is screwed into the second bore portion 17. The connection sleeve 18 is made from an essentially harder material, such as metal, than the tine 1. The connection sleeve 18 also has better shearing characteristics than the tine 1. The connection sleeve 18 absorbs the shearing forces during the transmission of forces acting on the raking-in portion 10 and passes these forces onto the carrier tube 2.

[0031] Figures 2 and 3 show the reel tine 1 arranged on the carrier tube 2 in a mounted condition. The reel tine 1 is retained by the screw 24 on the carrier tube 2. A rib 15, for the reinforcement, is on the tine 1. The rib 15 starts from the attachment portion 12 and ends in front of the free end 14. The rib 15 is unitarily formed with the raking-in portion and attachment portion 12 from the same plastic material.

[0032] Figures 4 to 6 show an embodiment of a reel tine 101, which corresponds essentially to the retainment of the embodiment of Figures 1 to 3 on the carrier tube. Accordingly, for the description of these parts, refer to the description of Figures 1 to 3. Components or portions corresponding to those of the embodiment of Figures 1 to 3 are provided with reference numerals, which compared to those of Figures 1 to 3, are increased by the numerical value 100. Only the differences are described below.

[0033] Different from the embodiment of Figures 1 to 3 is the attachment portion 112. A profiled strip 27 is unitarily formed with the attachment portion 112. The strip 27 extends laterally away from the attachment portion 112. The side face of the attachment portion 112, facing away from the profiled strip 27, has a groove 28. The cross-section of the groove 28 is adapted to receive the cross section of the profiled strip 27. The cross-sections are visible in Figures 5 and 7.

[0034] In Fig. 6 the arrangement of two reel tines 101 relative to the carrier tube 2 is shown. Here, the profiled strip 27 is connected in the drawing at its free ends to the left reel tine 101 by engaging in the groove 28. The grooves 28 are on the right and left sides of the shown reel tine 101. Accordingly, the profiled strip can be a separate part coupled with the grooves 28 of the attachment portions 112 or the strip 27 can be unitarily formed with the attachment portion as shown in Figure 4

[0035] Figures 8 and 9 illustrate a further embodiment of a reel tine according to the invention. The components serving for the attachment of the reel tine 201 and portions compared to those of the embodiment of Figure 1 are provided with reference numerals which are increased by the numerical value 200. The attachment of the reel tine 201, the design of the attachment portion 212, and the connection

sleeve 218 correspond to the embodiment of Fig. 1. Thus, for their description, refer to the description of Fig. 1.

[0036] Figures 8 and 9 serve only for the explanation of a further reinforcement of the reel tine 201 in the area of the raking-in portion 210. The two ribs 215 start from the attachment portion 212 and extend towards the tip 214. The ribs 215 are spaced apart from one another, with the greatest distance between the ribs 215 being at the attachment portion 212. The ribs 215 taper toward one another and eventually merge with one another. Two ribs 215 are on the tines 201. Thus, a higher rigidity is achieved. The cross-sections of these ribs 215 are visible in Fig. 9.

[0037] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.